

## Ionic Compounds

Ionic compounds form from the combination of metal and non-metals.

Atoms that lose electrons are called cations and have a positive charge.

Atoms that gain electrons are called anions and have a negative charge.

### Naming ionic compounds with metals that only form one ion

1. State the name of the first atom
2. Drop the last syllable (or 2) from the second atom name and add -ide

| Element | Name      | Element | Name     |
|---------|-----------|---------|----------|
| C       | Carbide   | S       | Sulfide  |
| N       | Nitride   | Cl      | Chloride |
| O       | Oxide     | Se      | Selenide |
| F       | Fluoride  | Br      | Bromide  |
| P       | Phosphide | I       | Iodide   |

### Name the following ionic compounds

| Compound                | Compound Name       |
|-------------------------|---------------------|
| $\text{CaBr}_2$         | Calcium Bromide     |
| $\text{Na}_2\text{O}$   | Sodium oxide        |
| $\text{Ag}_2\text{S}$   | Silver Sulfide      |
| $\text{K}_3\text{P}$    | Potassium phosphide |
| $\text{Al}_2\text{N}_3$ | Aluminum nitride    |

Given the compound name, identify the ions involved and provide the chemical formula

| Compound Name      | Cation           | Anion           | Compound                |
|--------------------|------------------|-----------------|-------------------------|
| Beryllium Chloride | $\text{Be}^{2+}$ | $\text{Cl}^-$   | $\text{BeCl}_2$         |
| Sodium Sulfide     | $\text{Na}^+$    | $\text{S}^{2-}$ | $\text{Na}_2\text{S}$   |
| Lithium Phosphide  | $\text{Li}^+$    | $\text{P}^{3-}$ | $\text{Li}_3\text{P}$   |
| Magnesium Nitride  | $\text{Mg}^{2+}$ | $\text{N}^{3-}$ | $\text{Mg}_3\text{N}_2$ |
| Calcium Oxide      | $\text{Ca}^{2+}$ | $\text{O}^{2-}$ | $\text{CaO}$            |

**Naming Ionic Compounds Using the Stock System** (for atoms that have more than one possible charge)

| Element       | 1+ | 2+ | 3+ | 4+ |
|---------------|----|----|----|----|
| Copper (Cu)   | X  | X  |    |    |
| Chromium (Cr) |    | X  | X  |    |
| Iron (Fe)     |    | X  | X  |    |
| Lead (Pb)     |    | X  |    | X  |
| Tin (Sn)      |    | X  |    | X  |

Follow the 1<sup>st</sup> atom name by the Roman numeral that represents its charge in parenthesis

Example                  Copper (I) Chloride =  $\text{CuCl}$           or          Copper (II) Chloride =  $\text{CuCl}_2$

**Name the following ionic compounds using the stock system**

| Compound                | Cation           | Anion           | Name                     |
|-------------------------|------------------|-----------------|--------------------------|
| $\text{FeCl}_2$         | $\text{Fe}^{2+}$ | $\text{Cl}^-$   | Iron (II) Chloride       |
| $\text{PbF}_4$          | $\text{Pb}^{4+}$ | $\text{F}^-$    | Lead (IV) Fluoride       |
| $\text{Sn}_3\text{P}_2$ | $\text{Sn}^{2+}$ | $\text{P}^{3-}$ | Tin (II) phosphide       |
| $\text{CoO}$            | $\text{Co}^{2+}$ | $\text{O}^{2-}$ | Cobalt (II) oxide        |
| $\text{CrP}$            | $\text{Cr}^{3+}$ | $\text{P}^{3-}$ | Chromium (III) phosphide |

Provide the chemical formula give the names of the following ionic compounds

| Name                     | Cation           | Anion           | Compound                |
|--------------------------|------------------|-----------------|-------------------------|
| Copper (II) Nitride      | $\text{Cu}^{2+}$ | $\text{N}^{3-}$ | $\text{Cu}_3\text{N}_2$ |
| Tin (IV) Oxide           | $\text{Sn}^{4+}$ | $\text{O}^{2-}$ | $\text{SnO}_2$          |
| Lead (II) Iodide         | $\text{Pb}^{2+}$ | $\text{I}^-$    | $\text{PbI}_2$          |
| Chromium (III) Phosphide | $\text{Cr}^{3+}$ | $\text{P}^{3-}$ | $\text{CrP}$            |
| Iron (III) Bromide       | $\text{Fe}^{3+}$ | $\text{Br}^-$   | $\text{FeBr}_3$         |

### Ionic compounds that contain polyatomic cations or anions

There is only one polyatomic cation,  $\text{NH}_4^+$  (ammonium ion)

When naming polyatomic anions, the charge for each member of a pair is the same. The ions differ by the number of atoms each member contains.

Example:  $\text{SO}_3^{2-}$  and  $\text{SO}_4^{2-}$

The name of the member of the pair with the fewer number of atoms ends in -ite, the other ends in -ate.

$\text{SO}_3^{2-}$  (sulfite) and  $\text{SO}_4^{2-}$  (Sulfate)

When forming compounds with polyatomic ions, place parenthesis around the entire ion before attempting to add subscripts (balance the charges)

### Provide the names of the following compounds which contain polyatomic ions

| Compound                     | Cation           | Anion              | Name               |
|------------------------------|------------------|--------------------|--------------------|
| $\text{Ba}(\text{NO}_3)_2$   | $\text{Ba}^{2+}$ | $\text{NO}_3^-$    | Barium Nitrate     |
| $\text{MgSO}_3$              | $\text{Mg}^{2+}$ | $\text{SO}_3^{2-}$ | Magnesium Sulfite  |
| $(\text{NH}_4)_3\text{P}$    | $\text{NH}_4^+$  | $\text{P}^{3-}$    | Ammonium phosphide |
| $\text{NaNO}_3$              | $\text{Na}^+$    | $\text{NO}_3^-$    | Sodium nitrate     |
| $\text{Pb}_3(\text{PO}_4)_2$ | $\text{Pb}^{2+}$ | $\text{PO}_4^{3-}$ | Lead(II) phosphate |

Form the compound containing polyatomic ions given the names

| Name                | Cation    | Anion       | Compound       |
|---------------------|-----------|-------------|----------------|
| Magnesium Phosphate | $Mg^{2+}$ | $PO_4^{3-}$ | $Mg_3(PO_4)_2$ |
| Ammonium Sulfite    | $NH_4^+$  | $SO_3^{2-}$ | $(NH_4)_2SO_3$ |
| Calcium Hydroxide   | $Ca^{2+}$ | $OH^-$      | $Ca(OH)_2$     |
| Lithium Nitrate     | $Li^+$    | $NO_3^-$    | $LiNO_3$       |
| Aluminum Sulfate    | $Al^{3+}$ | $SO_4^{2-}$ | $Al_2(SO_4)_3$ |

## Molecular Compounds

When naming binary molecular compounds, always name the more \_\_\_\_\_ atom first.

### Naming Rules

- If there is more than one of the 1<sup>st</sup> atom, precede the atom name by the appropriate prefix (di, tri, tetra, penta, hexa, hepta, octa, nona, deca)

Example:  $C_6O_2$  hexacarbon dioxide

- If there is only one of the first atom, do not precede the atom name by mono.  
 $CO_2$  = monocarbon dioxide       $CO_2$  = carbon dioxide
- Precede the second atom name by the appropriate prefix, including mono if there is only one of that atom. Drop the last syllable (or 2) and add -ide to the element name

$C_2O$  Dicarbon monoxide

| Element | Name      | Element | Name     |
|---------|-----------|---------|----------|
| C       | Carbide   | S       | Sulfide  |
| N       | Nitride   | Cl      | Chloride |
| O       | Oxide     | Se      | Selenide |
| F       | Fluoride  | Br      | Bromide  |
| P       | Phosphide | I       | Iodide   |

Provide the name of the following molecular compounds

| Compound  | Compound Name           |
|-----------|-------------------------|
| $P_6O_3$  | Hexaphosphorus trioxide |
| $NS_4$    |                         |
| $Se_8O$   |                         |
| $C_7Br_5$ |                         |
| $S_2F_2$  |                         |

Provide the Chemical Formulas given the following names

| Compound Name               | Compound |
|-----------------------------|----------|
| Dinitrogen monofluoride     |          |
| Nonaphosphorus decachloride |          |
| Sulfur hexabromide          |          |
| Tetracarbon pentasulfide    |          |
| Octanitrogen trifluoride    |          |